	DIPLOMA(ELECTRICAL)	
Sr. No.	**Code**	**Name of Paper**
		Semester - III
1	EL31	APPLIED ELECTRONICS
2	EL32	MECHANICAL ENGINEERING
3	EL33	ELECTRICAL TECHNOLOGY
4	EL34	ELECTRICAL ENGINEERING MATERIAL
5	EL35	NON CONVENTIONAL ENERGY SOURCE
6	EL36	ELECTRICAL INSTRUMENTS AND MEASUREMENT
7	EL37	ELECTRICAL WORKSHOP-1
		Semester – IV
1	EL41	ELECTRICAL MACHINE-1
2	EL42	ELECTRICAL CIRCUIT THEORY
3	EL43	GENERATION OF ELECTRICAL ENERGY
4	EL44	ELECTRICAL ESTIMATING AND COSTING
5	EL45	INSTRUMENTATION
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7	EL47	ELECTRICAL WORKSHOP-2
		Semester - V
1	EL51	ELECTRICAL MACHINE-2
2	EL52	POWER ELECTRONICS
3	EL53	TRANSMISSION & DISTRIBUTION
4	EL54	UTILIZATION OF ELECTRIC POWER
5	EL55	ELECTRICAL MAINTAINANCE AND REPAIR
		ELECTIVE – I

6	EL561	ELECTROMAGNETIC FIELD THEORY
6	EL562	ELECTRIC TRACTION SYSTEM
		ELECTIVE – II
7.	EL571	'C' PROGRAMMING
7	EL572	COMPUTER IN BUSINESS SYSTEM
		Semester - VI
1	EL61	ELECTRICAL MACHINE-3
2	EL62	MICROPROCESSOR AND ITS APPLICATION
3	EL63	SWITCHGEAR AND ITS PROTECTION
4	EL64	ELECTRICAL INTALLATION AND DESIGN
5	EL65	CONTROL SYSTEM ENGINEERING
		ELECTIVE – III
6	EL661	POWER SYSTEM ANALYSIS
6	EL662	ELECTRICAL MACHINE DESIGN
		ELECTIVE – IV
7	EL671	MANAGEMENT
7	EL672	ENTREPRENEURSHIP DEVELOPMENT
7	EL673	PRODUCTION SYSTEM MANAGEMENT

Code	Name of Paper
EE31	**APPLIED ELECTRONICS**

CONTENTS

1. Semiconductors :

1.1 Basic idea of semiconductors. N and P type semi-conductors
1.2 Potential barrier and temperature effect on barrier potential
1.3 Concept of energy band diagram for intrinsic and extrinsic semiconductors

2. Semi Conductor Diode :

2.1 P-N junction diode
2.2 P-N junction diode in forward and reverse bias
2.3 V-I characteristics of forward and reverse bias diodes

2.4 V-I characteristics of zener diode and its applications
2.5 Semiconductor diode as half wave rectifier, its efficiency and ripple factor
2.6 Semiconductor diode as full wave rectifier, its efficiency and ripple factor
2.7 Bridge rectifier, Overall comparison between half wave and other full wave rectifiers
2.8 Peak inverse voltage (PIV)
2.9 Use of filter circuit in rectifiers

2.9.1 L filter
2.9.2 C filter
2.9.3 LC section filter
2.9.4 p section filter

3. Bi-Polar Junction Transistor :

3.1 Concept of transistor
3.2 Types of transistor and their working in forward and reverse bias
3.3 Constants of transistor (a,b,g)
3.4 Analysis of transistor amplifier, load line
3.5 Operating point and biasing
3.6 Input - output characteristics in CB, CC and CE configuration
3.7 Low frequency small signal hybrid equivalent circuit of transistor
3.8 Derivation of voltage, current and power gain, input and output impedance of CE configuration

4. R-C Coupled and Power Amplifier :

4.1 Gain at low, mid and high frequency range, cut off frequencies
4.2 Concept of power amplifiers
4.4 Types of power amplifier
4.5 Class A power amplifier, output power analysis
4.6 Push-pull amplifier.
4.7 Class - B power amplifier

5. Special Devices :

5.1 Construction, operation, equivalent circuit and characteristics of

5.1.1 JFET, MOSFET, CMOS
5.1.2 Semiconductor photo devices such as LED, LDR, photo transistor
5.1.3 Varactor diode

6. Feed Back and Oscillators :

6.1 Basic concept of feedback and types of feedback
6.2 Advantages and disadvantages of negative feedback for gain, stability, frequency and nonlinear distortion
6.3 Voltage series, shunt and current series and shunt feed back circuit
6.4 Use of positive feedback for oscillators

6.5 Barkhausen criteria
6.6 Principles of RC phase shift, Wein bridge oscillator
6.7 Principle of Hartely, Colpits oscillator
6.9 Crystal oscillator and its frequency stability criteria

REFERENCE BOOKS :

1. Integrated Electronics : Millman & Halkias (TMH)
2. Electronics Principle : V.K.Mehta (Student Pub.)
3. Electronics Devices & Circuits : A. Mottershead (PHI)
4. Electronics Principle : Malvino (TMH)
5. Electronics Devices & Circuits : Sanjeev Gupta

Code	Name of Paper	Lecture
EE32	**MECHANICAL ENGINEERING**	2

CONTENTS

1. Mechanical Properties of Metals :

1.1 Definitions -

1.1.1 Elasticity
1.1.2 Plasticity
1.1.3 Ductility
1.1.4 Brittleness
1.1.5 Toughness
1.1.6 Hardness
1.1.7 Malleability
1.1.8 Fatigue

1.2 Examples of applications of above terms related to electrical engineering.

2. Basic Concept of Thermal Engineering :

2.1 Energy
2.2 Internal energy
2.3 Potential energy
2.4 Kinetic energy
2.5 Heat
2.6 Work and enthalpy
2.7 Specific heat
2.8 Specific heat ratio
2.9 Characteristics gas equation
2.10 Universal gas constant
2.11 First law of thermodynamics
2.12 Second law of thermodynamics

3. Hydraulics :

3.1 Physical properties of a fluid

3.1.1 Density
3.1.2 Specific volume
3.1.3 Specific weight
3.1.4 Specific gravity
3.1.5 Viscosity

3.2 Pascal's law

4. Pressure Measuring Devices :

4.1 Manometers

4.1.1 Simple manometers
4.1.2 Differential manometers
4.1.3 Inverted 'U' tube

4.2 Pressure gauges
4.3 Continuity equation

5. Bernaulli's Theorem :

5.1 Energy of a fluid

5.1.1 Pressure energy
5.1.2 Velocity energy
5.1.3 Datum energy

5.2 Venturimeter & its uses

6. Pumps :

6.1 Types of lumps
6.2 Centrifugal pump
6.3 Reciprocation pump
6.4 Their relative advantages and performance

7. Turbine :

7.1 Working principles and types of water turbines
7.2 Selection of turbines
7.3 Brief idea of turbine

7.3.1 Pelton wheel turbine
7.3.2 Francis turbine

8. Properties of Steam :

8.1 Generation of steam at constant pressure
8.2 Enthalpy of water wet steam
8.3 Enthalpy of dry saturated stem
8.4 Dryness fraction
8.5 Superheated steam
8.6 Latent enthalpy
8.7 Enthalpy of steam
8.8 Specific volume
8.7 External work during evaporation
8.8 Internal content enthalpy
8.9 Internal energy of steam
8.10 Use of steam table
8.11 Simple numerical problems

9. Boilers :

9.1 Classification of boilers
9.2 Working of common boilers

9.2.1 Babcox and Wilcox
9.2.2 Chichram boiler

9.3 Boiler mounting and their accessories
9.4 Introduction to modern high pressure boiler for thermal power station (Lamont boiler, weffler boiler, Benson boiler and Velox boiler).

10. Steam Turbines :

10.1 Introduction
10.2 Types of steam turbine
10.3 Working principle of steam turbine
10.4 Uses and advantages of steam turbine

11. I.C. Engines :

11.1 I.C. engine cycle (otto, diesel)
11.2 Working principle of

11.2.1 Two stroke petrol and diesel
11.2.2 Four stroke petrol and diesel

12. Transmission :

12.1 Belt drive
12.2 Rope drive
12.3 velocity ratio
12.4 Tension ratio
12.5 Effect of centrifugal tension
12.6 Application of these drives

13. Lubrication :

13.1 Object of lubrication
13.2 Different methods of lubrication
13.3 Properties of lubricants

REFERENCE BOOKS :

1. Thermodynamics & Heat Power Engg. : Mathur & Mehta
2. Thermal Engg. : P.L. Ballaney
3. Hydraulics & Hyd. Machines : Khurmi
4. Strength of Materials : G.C.Singh
5. Heat Engines : Pande & Shah

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Code	Name of Paper	Lecture
EE33	**ELECTRICAL TECHNOLOGY**	3

CONTENTS

1. D.C. Circuits :

1.1 Resistance, specific resistance, Ohm's law, Resistance in series, parallel and series parallel circuits.
1.2 Kirchhoff's laws
1.3 Application of Kirchhoff's laws

2. Capacitance :

2.1 Capacitor
2.2 Capacitance of an isolated sphere
2.3 Parallel plate capacitor
2.4 Special cases of parallel plate capacitor
2.5 Cylindrical capacitor
2.6 Capacitor in series and parallel
2.7 Capacitor with compound dielectric
2.8 Energy stored in capacitor
2.9 Charging and discharging of a capacitor, time constant
2.10 Different types of capacitor used in various electrical applications.

3. Magnetic Circuits :

3.1 Introduction
3.2 Comparison between magnetic circuit and electric circuits
3.3 Behavior of magnetic circuits
3.4 Composite magnetic circuits

3.5 Parallel magnetic circuits
3.6 B-H curve
3.7 Rise of current in inductive circuit
3.8 Decay of current in inductive circuit
3.9 Eddy current and Eddy current loss

4. Phasor Algebra :

4.1 Mathematical representation of a vector
4.2 Symbolic notation
4.3 Significance of operator-j
4.4 Conjugate complex number
4.5 Trigonometrical form of vector representation
4.6 Exponential form of vector representation
4.7 Polar form of vector representation
4.8 Addition and subtraction of vector
4.9 Multiplication and division of vector quantity
4.10 120o operator

5. A.C. Circuits :

5.1 Alternating quantity and its equation
5.2 Maximum, Average and RMS values.
5.3 Form factor
5.4 Behaviour of R, L and C in A.C. circuits with phasor diagrams
5.5 A.C. through R-L circuit, power factor, active and reactive component of current, power
5.6 Q-factor of a coil
5.7 A.C. through R-C circuit, dielectric loss and power factor of a capacitors
5.8 Solving series R-L-C circuits
5.9 Solving A.C. parallel circuit by phasor diagram and phasor algebra
5.10 Solving A.C. series and parallel circuits.

6. Polyphase System :

6.1 Need and advantage of 3-phase system
6.2 Generation of 3-phase voltage
6.3 Phase sequence
6.4 Star-Delta connections
6.5 Phase and Line relations of voltage and current in star -delta connections (for balanced load)
6.6 Expression of power in 3-phase circuits (for balanced load)

7. Battery :

7.1 Types of storage batteries
7.2 Construction and working of Lead acid batteries and Ni-Fe batteries
7.3 Discharging and recharging of Lead acid batteries
7.4 Care of Lead acid batteries

7.5 Ampere and watt-hour efficiencies

REFERENCE BOOKS :

1. Electrical Engineering(Hindi & English) : K.D.Sharma
2. Electrical Technology : B.L.Theraja
3. Electrical Engineering (Part-I) : D.R.Nagpal
4. Electrical Technology : J.B.Gupta
5. Basic Electrical Engg. : V.N. Mittal
6. Basic Electrical Engg. : Nagrath & Kothari

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Code	Name of Paper	Lecture
EE34	**ELECTRICAL ENGINEERING MATERIALS**	3

CONTENTS

1. Classification :

1.1 General requirement of electrical engineering materials,
1.2 Classification of materials into conducting, semi-conducting and insulating materials through a brief reference to atomic structure

2. Conducting Materials :

2.1 Resistivity
2.2 Factors affecting resistivity such as

2.2.1 Temperature
2.2.2 Alloying
2.2.3 Aging effect

2.3 Classification of conducting materials into -

2.3.1 Low resistivity materials
2.3.2 High resistivity materials

3. Low Resistivity Materials :

3.1 General properties of copper, aluminium and steel as conductors

3.1.1 Resistivity
3.1.2 Temperature coefficient
3.1.3 Contact resistance
3.1.4 Melting point

3.1.5 Density

3.2 Mechanical properties of hard and annealed copper, aluminium and low and high tensile steel

3.2.1 Mechanical strength
3.2.2 Resistance to corrosion
3.2.3 Ductility
3.2.4 Solderability etc.

3.3 Use of copper, aluminium with steel as a conductors and their comparison

4. High Resistivity Materials :

4.1 General properties, composition and use of high resistivity materials as

4.1.1 Nichrome
4.1.2 Eureka
4.1.3 Manganin
4.1.4 German silver
4.1.5 Tungsten
4.1.6 Platinum

4.2 Materials for lamp filaments and their properties

5. Contact Materials :

5.1 General properties and uses of contact materials such as

5.1.1 Silver
5.1.2 Tungsten
5.1.3 Copper

6. Brush Materials :

6.1 General properties and uses of brush materials such as

6.1 Carbon
6.2 Electro graphite
6.3 Metal graphite

7. Insulating Materials :

7.1 Electrical properties

7.1.1 Volume resistivity
7.1.2 Surface resistance
7.1.3 Dielectric strength
7.1.4 Dielectric constant

7.2 Physical properties

- 7.2.1 Specific gravity
- 7.2.2 Viscosity
- 7.2.3 Hygroscopicity

7.3 Thermal properties

- 7.3.1 Heat resistance
- 7.3.2 Thermal conductivity
- 7.3.3 Ignitibility
- 7.3.4 Thermal expansion and contraction
- 7.3.5 Thermal stability of composition

7.4 Chemical properties

- 7.4.1 Solubility
- 7.4.2 Chemical resistance
- 7.4.3 Weatherability

7.5 Classification of insulating materials on the basis of temperature limit

7.6 Composition, properties and applications of

- 7.6.1 Fibrous materials
- 7.6.2 Ceramics
- 7.6.3 Mica and mica products
- 7.6.4 Asbestos and asbestos products
- 7.6.5 Glass and glass products
- 7.6.6 Natural and synthetic rubber
- 7.6.7 PVC
- 7.6.7 Bakelite

7.7 Properties of liquid insulating materials such as

- 7.7.1 Transformer oils
- 7.7.2 Mineral insulating oils

7.8 Properties of gaseous insulating materials such as

- 7.8.1 Hydrogen
- 7.8.2 Air
- 7.8.3 SF6

8. Magnetic Materials :

8.1 Terminology and classification

- 8.1.1 Diamagnetic material
- 8.1.2 Paramagnetic material
- 8.1.3 Ferromagnetic material

8.2 Effect of Curie temperature
8.3 Hysteresis loop
8.4 Soft and hard magnetic materials
8.5 Different magnetic materials such as

8.5.1 Soft ferrites
8.5.2 Silicon steel
8.5.3 Nickel Iron alloys
8.5.4 Cobalt steel
8.5.5 Tungsten steel
8.5.6 ALNICO
8.5.7 ALNI

9. Semiconducting Materials and their Properties :
10. Special Purpose Materials :

10.1 Metals/ alloys for fuses with their properties composition & uses
10.2 Composition and properties of soldering materials
10.3 Materials for thermocouple
10.4 Materials for bimetal
10.5 Super conductivity and super conducting materials application and recent trend in this field.

REFERENCE BOOKS :

1. Electrical Engineering Materials : T.T.T.I. Madras
2. Electrical Engineering Materials : Raina, Bhattacharya
3. Electrical Engg. Materials : B.R. Sharma

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Code	Name of Paper	Lecture
EE35	**NON-CONVENTIONAL ENERGY SOURCES**	3

CONTENTS

1. Sources of Energy :

1.1 Different sources
1.2 Application of sources with reference to Rajasthan

2. Solar Energy :

2.1 Application
2.2 Unit of solar power and solar energy
2.3 Historical review and future prospects
2.4 Schematic diagram of a solar thermal power plant
2.5 Solar central receiver thermal power plant
2.6 Solar pond thermal plant
2.7 Solar thermal power supply system for space station
2.8 Introduction to photo voltaic system
2.9 Merits and limitation of solar PV system
2.10 Principle of photo voltaic cell
2.11 V-I characteristics of solar cell
2.12 Efficiency of a solar cell
2.13 Transparent, insulating and absorbing materials
2.14 Building heating by active and passive system
2.15 Solar still, solar dryer and solar cooker
2.16 Solar seasoning of timber

3. Wind Energy :

3.1 Introduction to wind energy
3.2 Merits and demerits of wind energy
3.3 Wind power and energy pattern factor
3.4 Wind machine

3.4.1 Horizontal axis wind machine
3.4.2 Vertical axis wind machine

3.5 Site selection of a wind machine
3.6 Maintenance of a wind machine
3.7 Efficiency of a wind machine
3.8 Application of a wind machine

4. Bio-Gas Energy :

4.1 Introduction to bio-gas energy
4.2 Properties of bio-gas
4.3 Principle of bio-gas production
4.4 Chemical and microbiological processors
4.5 Factors which affects bio-gas production
4.6 Different feed stocks for bio-gas production
4.7 Classification of bio-gas plant

4.7.1 Fixed dome type
4.7.2 Floating type

4.8 Comparison between fixed dome and floating type bio-gas plant
4.9 Site selection of bio-gas plant
4.10 Selection of size and specification of bio-gas plant
4.11 Water removing devices

4.12 Maintenance of bio-gas plants
4.13 Bio gas lamp and chulha
4.14 Bio gas storage and transportation
4.15 Purification of bio-gas
4.16 Environmental effect of bio-gas plant
4.17 Visit to a bio-gas plant
4.18 Preparation of a project report on a bio-gas plant

5. Ocean Energy :

5.1 Introduction to ocean energy
5.2 Types of ocean energy

5.2.1 Open cycle
5.2.2 Closed cycle

6. Appropriate Technology :

6.1 Introduction to appropriate technology
6.2 Concepts of appropriate technology
6.3 Need of appropriate technology
6.4 Merits and demerits
6.5 Comparison between appropriate and modern technology
6.6 Application

REFERENCE BOOKS :

1. Energy technology : S.Rao & B.B. Parulekar
2. Non-conventional Energy Sources : A.N. Mathur & N.S.Rathore
3. Non-conventional Sources of energy and appropriate technology : D.M. Agrawal & S.K. Bhatnagar
4. Non-conventional Energy Sources : G.D.Rai
5. Solar Energy : Garg & Prakash

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Code	Name of Paper	Lecture
EE36	**ELECTRICAL INSTRUMENTS AND MEASUREMENT**	2

CONTENTS

1. Classification of Measuring Instruments :

1.1 Indicating, recording and integrating instruments
1.2 Accuracy and sensitivity
1.3 Types of errors
1.4 Deflecting, controlling and damping torque
1.5 Construction, working principle and operation of PMMC, moving iron (MI), dynamometer type ammeter and voltmeter.
1.6 Rectifier type instruments
1.7 Electrostatic voltmeter
1.8 Range extension using shunts and multipliers

2. Wattmeters and Energy Meters :

2.1 Construction, operation and working principles

2.1.1 Dynamometer type wattmeter
2.1.2 Induction type wattmeter

2.2 Blondels theorem and measurement of power by two wattmeter method in 3-phase circuits
2.3 Single phase and three phase induction type energy meter
2.4 Testing of single phase induction type energy meter by direct and phantom loading.
2.5 Adjustments of single phase induction type energy meter
2.6 Brief study of static energy meter (single and 3 phase)

3. Measurement of Resistance :

3.1 Classification of resistance
3.2 Measurement of low resistance by Kelvin's double bridge
3.3 Measurement of medium resistance by Ammeter and Voltmeter, Whetstone's bridge, Substitution methods
3.4 Measurement of high resistance and insulation resistance
3.5 Megger, Earth tester and Ohmmeter

4. Potentiometers :

4.1 Types of A.C. and D.C. potentiometers
4.2 Construction
4.3 Standardisation
4.4 Applications

5. A.C. Bridges :

5.1 General equation for bridge balance
5.2 Maxwell's inductance bridge
5.3 Maxwell's inductance - capacitance bridge
5.4 Anderson's bridge
5.5 Schering bridge
5.6 Wein's bridge for frequency measurements

6. Brief study of:

6.1 CRO
6.2 Electronic voltmeter

REFERENCE BOOKS :

1. Electrical Measurement & Instrumentation : A.K.Sawhney
2. Electrical Measurement & Instruments : J.B.Gupta
3. Electrical Measurement : E.W.Golding
4. Electrical Measurement : D.R.Nagpal

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Code	Name of Paper	Lecture
EE37	**ELECTRICAL WORKSHOP - I**	2

CONTENTS

1. Wiring :

1.1 System of wiring
1.2 Types of wiring and their application

2. Wire Joints :

2.1 Different types of joints
2.2 Their uses

3. Wiring Diagram of Different Lamp Control Circuits and Their Working :

3.1 Bell indicator
3.2 Fluorescent tube (single and double)
3.3 Mercury vapour lamp
3.4 Sodium vapour lamp
3.5 Neon sign lamp
3.6 Flasher

4. Study the Following Circuit :

4.1 Emergency light
4.2 Voltage stabilizer
4.3 Domestic refrigerator

5. Fault Investigation and Testing :

5.1 Specification, wiring, dismantling, fault investigation, repairing, assembling and testing the following electrical appliances -

5.1.1 Electric heater
5.1.2 Electric immersions heater
5.1.3 Room heater
5.1.4 Electric kettle
5.1.5 Electric soldering iron

6. Automobile Electrical System :

6.1 Dynamo
6.2 Self starter
6.3 Voltage regulator
6.4 Ignition coil
6.5 Lighting circuit

6.5.1 Four wheeler
6.5.2 Two wheeler

Code	Name of Paper	Lecture
EE41	**ELECTRICAL MACHINES - I**	2

CONTENTS

1. D.C. Generator :

1.1 Construction of D.C. machine
1.2 Lap and wave winding (Brief idea)
1.3 Principle of D.C. generator
1.4 Excitation methods and different types of D.C. Generator
1.5 E.M.F. equation
1.6 D.C. generator characteristics
1.7 Losses
1.8 Efficiency and condition for maximum efficiency
1.9 Concept of armature reaction
1.10 Effect of armature reaction on commutation and generated voltage.

2. D.C. Motor :

2.1 Different types of D.C. motor
2.2 Principle of D.C. motor
2.3 Concept of back emf
2.4 Torque, speed and power relations

2.5 Starters for D.C. shunt and compound motors
2.6 Characteristics of D.C. motor
2.7 Speed control of D.C. motor

- 2.7.1 Field control
- 2.7.2 Armature control
- 2.7.3 Series parallel control

2.8 Testing of D.C. machine by

- 2.8.1 Direct loading
- 2.8.2 Swineburn's test
- 2.8.3 Hopkinson's test and
- 2.8.4 Calculation of efficiency as a generator and motor from above test

3. Transformer :

3.1 Construction of single phase and three phase transformer
3.2 Principle of operation
3.3 Emf equation and Turn ratio
3.4 Idea of leakage reactance
3.5 Transformer phasor diagram

- 3.5.1 At no load
- 3.5.2 At load (Lagging, Leading and UPF)

3.6 Equivalent circuit of single phase transformer
3.7 Losses, efficiency and regulation
3.8 Condition for maximum efficiency
3.9 All day efficiency
3.10 Transformer testing

- 3.10.1 By direct loading
- 3.10.2 By open circuit and short circuit test
  - 3.10.2.1 Determination of equivalent circuit parameters
- 3.10.3 Back to back test

3.11 Parallel operation of single-phase transformer with equal and unequal voltage ratio.
3.12 Off load and on load tap changers
3.13 Auto transformer
3.14 Poly phase connection (Descriptive study)

- 3.14.1 Scott connection
- 3.14.2 Open-Delta connection
- 3.14.3 Star-Star connection
- 3.14.4 Delta - Delta connection

3.15 Parallel operation of 3-phase transformer

Code	Name of Paper	Lecture
EE42	**ELECTRICAL CIRCUIT THEORY**	2

CONTENTS

1. Network Parameters :

1.1 Active and passive
1.2 Linear and non-linear
1.3 Unilateral and bilateral
1.4 Lumped and distributed
1.5 Time varying and time invariant parameters
1.6 Voltage and current sources (ideal and practical)
1.7 Dependent and Independent sources
1.8 Source conversion techniques

2. Network Theorems :

2.1 Kirchhoff's law, node and mesh analysis, Solution by Kramer's rule up to three variables
2.2 Superposition theorem
2.3 Thevenin's theorem
2.4 Norton's theorem
2.5 Maximum power transfer theorem
2.6 Tellegen's theorem
2.7 Star-delta transformation
2.8 Millman's theorem

3. Resonance :

3.1 Series resonance
3.2 Parallel resonance
3.3 Q-factor, bandwidth, selectivity, half power frequencies, graphical representations
3.4 Importance of resonance

4. Circuit Transients :

4.1 Introduction to Laplace transform and inverse Laplace transformations
4.2 Laplace transformation of following functions

4.2.1 Unit impulse function

4.2.2 Unit step function
4.2.3 Exponential function
4.2.4 Ramp function
4.2.5 Sinusoidal function
4.2.6 Derivative function
4.2.7 Integral function

4.3 Laplace transformation theorem

4.3.1 Shifting Theorem
4.3.2 Shift in 's' domain theorem
4.3.3 Complex differentiation theorem
4.3.4 Final value theorem
4.3.5 Initial value theorem
4.3.6 Complex integration theorem

4.4 Solution of series RL, RC and RLC circuits by Laplace transformation

5. Two Port Network :

5.1 z-parameters
5.2 y-parameters
5.3 h-parameters
5.4 ABCD- parameters
5.5 Inter relation among z,y,h and ABCD parameters.
5.6 Special types of network such as T, p, Bridge - T, Parallel-T and Lattice.

6. Complex Frequency and Pole-Zero Diagram :

6.1 Concept of complex frequency
6.2 Poles and zeros of simple function
6.3 Ploting of poles and zero diagram of a simple function (up to second order)
6.4 Necessary conditions of pole and zero locations of driving point functions.

REFERENCE BOOKS :

1. Electrical Networks : Soni & Gupta
2. Electrical Network Analysis : Umesh Sinha
3. Electrical Network Analysis : G.K.Mithal
4. Text Book of Circuit Theory : G.S. Verma
5. Electrical Circuit : M.E. Valvenkerberg

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Code	Name of Paper	Lecture

CONTENTS

5.4 Pulverising plant
5.5 Draft system
5.6 Boilers
5.7 Ash handling plant
5.8 Turbine
5.9 Different types of condensers
5.10 Cooling towers and ponds
5.11 Feed water heater
5.12 Economiser
5.13 Super heater and reheater
5.14 Air preheater

6. Hydro Electric Power Plants :

6.1 Selection of site
6.2 Advantages and disadvantages of hydro power plant
6.3 Hydrology
6.4 Classification based on

6.1.1 Water flow regulations
6.1.2 Load
6.1.3 Head

6.5 Element of hydro power plant and their functions

6.5.1 Dam
6.5.2 Storage reservoir
6.5.3 Fore bay
6.5.4 Surge tank
6.5.6 Pen stocks
6.5.7 Spill way
6.5.8 Head race and tailrace
6.5.9 Types of turbines
6.5.10. Specific speed

6.6 Brief idea about small and mini hydro plants
6.7 Pumped storage plant

7. Nuclear Power Station :

7.1 Introduction and selection of site
7.2 Block diagram of plant and its working
7.3 Main components and their function
7.4 Energy mass relationship
7.5 Energy due to fission and fusion
7.6 Nuclear chain reaction
7.7 Multiplication factor and critical size
7.8 Moderators materials
7.9 Fissile and fertile materials

7.10 Classification of Nuclear reactor, main parts and their functions
7.11 Safety measures required in nuclear plant
7.12 Disposal of nuclear waste

8. Diesel Power Plants :

8.1 Main components and working of diesel power plant with the help of block diagram
8.2 Advantage and disadvantage of diesel power plant
8.3 Application of diesel power plant
8.4 Principle and operation of gas turbine plants
8.5 Comparison of different power stations
8.6 Inter connection of power stations

REFERENCE BOOKS :

1. Generation of Electrical Energy : B.R. Gupta
2. Power Plant Engg. : Domkundwar
3. A course in Electrical Power : Soni, Gupta, Bhatnagar

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Code	Name of Paper	Lecture
EE51	**ELECTRICAL MACHINES - II**	3

CONTENTS

1. Induction Motor :

1.1 Production of rotating magnetic field by two phase and three-phase supply
1.2 Construction of slip ring and squirrel cage motors
1.3 Principle of operation
1.4 Slip
1.5 Torque Production

1.5.1 Gross torque and shaft torque
1.5.2 Starting torque
1.5.3 Running torque
1.5.4 Maximum torque
1.5.5 Full load torque
1.5.6 Relation between starting, maximum and full load torque

1.6 Torque-slip characteristics

1.7 Power stages and efficiency
1.8 Equivalent circuit: approximate and exact
1.9 Phasor diagram
1.10 No-load and blocked rotor tests
1.11 Circle diagram
1.12 Methods of starting
1.13 Speed control of induction motors

1.13.1 Rotor resistance control
1.13.2 Stator voltage control
1.13.3 Frequency control
1.13.4 Pole changing method
1.13.5 Cascade control
1.14 Cogging and crawling
1.15 Double cage induction motor
1.16 Industrial applications

2. Single Phase Induction Motor :

2.1 Double revolving field and cross-filed theory
2.2 Different types and their construction
2.3 Methods of starting
2.4 Characteristics of single-phase motors
2.5 Industrial applications

3. Alternators :

3.1 Constructional features
3.2 Principle of operation
3.3 Winding factors
3.4 EMF equation
3.5 Idea of leakage reactance (cylindrical rotor) and armature reaction
3.6 Synchronous impedance
3.7 Phasor diagram at different power factors
3.8 Voltage regulation
3.9 Open circuit and short circuit tests
3.10 Calculation of regulation by synchronous impedance and m.m.f methods
3.11 Parallel operation of three phase alternators
3.12 Effect of variation in excitation and prime mover power on the performance of alternator

4. Synchronous Motors :

4.1 Construction and principle of operation
4.2 Phasor diagram at no load and on load (cylindrical rotor)
4.3 Power equation
4.4 V - curves and inverted V- curves
4.5 Methods of starting

4.6 Synchronous motor operation at

4.6.1 Constant input power and variable excitation
4.6.2 Constant excitation and Variable input power

4.7 Synchronous condenser
4.8 Comparison of induction motor and synchronous motor
4.9 Application of synchronous motor

Code	Name of Paper	Lecture
EL45	**INSTRUMENTATION AND CONTROL SYSTEM**	3

EF 45

CONTENTS

1. Basic Concept of Measurement :

1.1. Introduction.
1.2. Generalized configuration of measuring system.
1.3. Characteristics of measuring devices

1.3.1. Accuracy.
1.3.2. Resolution.
1.3.3. Precision.
1.3.4. Expected Value.
1.3.5. Error (Gross, Systematic and Random error).
1.3.6. Sensitivity.
1.3.7. Linearity.
1.3.8. Hysterisis.
1.3.9. Repeatability.
1.3.10. Threshold

1.4. Calibration of measuring devices.

2. Transducers :

2.1 Concept of Primary and Secondary transducers.
2.2 Difference between active and passive transducer.
2.3 Difference between analog and digital transducer.
2.4 Construction and working of the following transducers and measurement of quantities such as Displacement (Linear and angular), Strain, Stress, Temperature, Pressure, Flow level, pH value.

2.4.1 Potentiometers
2.4.2 Strain gauge (resistance and semiconductor type)

2.4.3 Resistance Temperature detectors (RTD)
2.4.4 Thermo couples, thermistor.
2.4.5 Linear variable differential transformer (LVDT).
2.4.6 Capacitive transducer
2.4.7 Load Cell
2.4.8 Piezo Electric Transducer
2.4.9 Photo Cells
2.4.10 Photo Voltaic Cell
2.4.11 Techogenerator
2.4.12 Ultrasonic method for level measurement
2.4.13 Electro magnetic flow meter.
2.4.14 pH electrodes

3. Signal Conditioning :

3.1 Introduction.
3.2 DC Signal Conditioning.
3.3 AC Signal Conditioning.
3.4 Brief idea of data acquisition system

DEE46 ELECTRICAL MACHINE DESIGN

2L+IT **MM: 100** **Exam. Hrs. : 3**

1. **General:** Basic Principles of electrical machine design. Factors and limitations in design, main dimensions, output equations and output co-efficient, classification of magnetic materials and allowable flux densities. Calculation of magnetic circuits, magnetizing, current, coils for given ampere-turns, real and apparent flux densities. Tapered teeth. Carter's co-efficient, leakage fluxes reactances. Classification of insulation materials and their temperature ranges.
2. **Armature winding:** General features of armature windings, single layer and double layer and commutator windings, integral and fractional slot windings, winding factors.
3. **Heating cooling and ventilation:** Heat dissipation, heat flow, heating cooling curves. Heating cooling cycles, estimation of maximum temperature rise, cooling media. Quantity of cooling media. Types of enclosures, ratings, heat dissipation. Methods of ventilation.
4. **Application of above design principles to the following design:** Power transformers and distribution transformer, induction machines and synchronous machines.

Recommended books:

1. A.K. Sahney – Electrical machine design
2. V.M. Mittle – Electrical Machine design
3. R.K. Agrawal – Electrical Machine design

Code	Name of Paper	Lecture
EE51	**ELECTRICAL MACHINES - II**	3

CONTENTS

1. Induction Motor :

1.1 Production of rotating magnetic field by two phase and three-phase supply
1.2 Construction of slip ring and squirrel cage motors
1.3 Principle of operation
1.4 Slip
1.5 Torque Production

1.5.1 Gross torque and shaft torque
1.5.2 Starting torque
1.5.3 Running torque
1.5.4 Maximum torque
1.5.5 Full load torque
1.5.6 Relation between starting, maximum and full load torque

1.6 Torque-slip characteristics
1.7 Power stages and efficiency
1.8 Equivalent circuit: approximate and exact
1.9 Phasor diagram
1.10 No-load and blocked rotor tests
1.11 Circle diagram
1.12 Methods of starting
1.13 Speed control of induction motors

1.13.1 Rotor resistance control
1.13.2 Stator voltage control
1.13.3 Frequency control
1.13.4 Pole changing method
1.13.5 Cascade control
1.14 Cogging and crawling
1.15 Double cage induction motor
1.16 Industrial applications

2. Single Phase Induction Motor :

2.1 Double revolving field and cross-filed theory
2.2 Different types and their construction
2.3 Methods of starting
2.4 Characteristics of single-phase motors
2.5 Industrial applications

3. Alternators :

3.1 Constructional features
3.2 Principle of operation
3.3 Winding factors
3.4 EMF equation
3.5 Idea of leakage reactance (cylindrical rotor) and armature reaction
3.6 Synchronous impedance
3.7 Phasor diagram at different power factors
3.8 Voltage regulation
3.9 Open circuit and short circuit tests
3.10 Calculation of regulation by synchronous impedance and m.m.f methods
3.11 Parallel operation of three phase alternators
3.12 Effect of variation in excitation and prime mover power on the performance of alternator

4. Synchronous Motors :

4.1 Construction and principle of operation
4.2 Phasor diagram at no load and on load (cylindrical rotor)
4.3 Power equation
4.4 V - curves and inverted V- curves
4.5 Methods of starting
4.6 Synchronous motor operation at

4.6.1 Constant input power and variable excitation
4.6.2 Constant excitation and Variable input power

4.7 Synchronous condenser
4.8 Comparison of induction motor and synchronous motor
4.9 Application of synchronous motor

Code	Name of Paper	Lecture
EE52	**POWER ELECTRONICS**	2

CONTENTS

1. Introduction :

1.1 Principles, construction ,characteristics and ratings of

1.1.1 SCR
1.1.2 DIAC
1.1.3 TRIAC
1.1.4 UJT
1.1.5 LASCR

1.2 Series connection of SCR
1.3 Parallel connection of SCR
1.4 UJT as a relaxation oscillator
1.5 Snubber circuit
1.6 Transistor analogy of SCR
1.7 Comparison of SCR and TRIAC
1.8 Over voltage and over current protection circuit for SCR.

2. Power Control Rectification :

2.1 Phase control of SCR
2.2 Different phase controlling circuits

2.2.1 R
2.2.2 RC
2.2.3 UJT(Ramp)
2.2.4 UJT (Pedestal and Ramp)
2.2.5 Transformer circuit

2.3 Different methods of turn off of SCR

2.4 Single-phase and three-phase half wave and full wave rectifier using SCR

2.4.1 With resistive load
2.4.2 With inductive load
2.4.3 With flywheel diode

3. Inverters :

3.1 Basic principle of inverter
3.2 Series inverter
3.3 Parallel inverter
3.4 Single phase voltage source inverter
3.5 Three phase bridge inverter
3.6 Applications

4. Practical Application of SCR :

4.1 Chopper
4.2 Cyclo converter
4.3 UPS
4.4 SMPS

4.4.1 Types of SMPS
4.4.2 Protection circuits
4.4.3 Merits and demerits of SMPS

5. AC Stabilizers :

5.1 Introduction
5.2 Working and basic circuits of

5.2.1 Resonator stabilizer
5.2.2 Electro-mechanical stabilizer
5.2.3 Electronic stabilizer

6. Electronic Motor Speed Control :

6.1 Introduction
6.2 Speed control using SCR for

6.2.1 D.C. shunt motor and series motor
6.2.2 Single phase and three phase induction motor
6.2.3 Slip ring induction motor

7. Timers :

7.1 Types of timer circuits
7.2 Principles and operation
7.3 Electronic timers
7.4 D.C. operated timer
7.5 A.C. operated timer

8. High Frequency Heating :

8.1 Introduction (heating and welding)
8.2 Principle of induction and dielectric heating
8.3 Sources of high frequencies
8.4 Power requirement and application
8.5 Resistance welding types

Code	Name of Paper	Lecture
EE53	**TRANSMISSION AND DISTRIBUTION**	3

RATIONALE

Diploma holders are mostly employed in electricity boards and industries where they are supposed to erect low voltage lines, overhead and underground cables and substation and to erect HV and EHV lines and substation. For doing the above job it is expected that the student are made aware and given practice of the above aspects of lines and substations including safety practices, standardised maintenance schedule, Indian Electricity act and relevant Indian Standards.
As regards design aspects of lines are concerned he should be aware of the various consideration taken into account for this and not actual design. For this design of simple distribution system is needed. It is not only sufficient to

construct, operate and maintain a power system but to run it efficiently. For this an engineer should be made aware of the prevailing practices in electricity board which may result in efficient and economical working of the system.

CONTENTS

5.1 Layout of distribution system, feeders, distributors and service mains
5.2 Radial and ring main distributors
5.3 Voltage drop calculation for LT and HT lines in A.C. and D.C. distributors

6. Construction of Underground Distribution Lines :

6.1 Underground cables - types, construction
6.2 Selection of LT and HT cables
6.3 Laying of underground cables
6.4 Comparison of underground distribution systems
6.5 Cable grading and its analysis

7. Construction of Overhead Distribution Lines :

7.1 Survey of LT lines
7.2 Planning of construction work
7.3 Methods of erection of supports
7.4 Erection of conductors - laying out conductors
7.5 Raising and setting of poles, guys, stays
7.6 Fixing of insulators and cross arms
7.7 Guarding.

REFERENCE BOOKS :

1. Electrical Power Soni,Gupta & Bhatnager
2. Electrical Power J.B.Gupta
3. Power System V.K. Mehta
4. Transmission & Distribution Raina & Bhattacharyaof Electrical Power
5. Electrical Power S.L. Uppal

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Code	Name of Paper	Lecture
EE54	**UTILIZATION OF ELECTRICAL POWER**	3

RATIONALE

The knowledge of utilization of electrical power is important for an electrical engineer. This subject assumes importance in view of the fact that an engineer has to work in a wide spectrum of activities wherein he has to make selections from technical, economical and availability considerations.
The subject contents are designed to meet the above requirements and an engineer after undergoing this course shall be in a position to operate and keep the equipment used in utilization of electrical power.

CONTENTS

4.3 Electrical sources of light

4.3.1 Design of lighting schemes for domestic, commercial and industrial premises based upon illumination level required for various works.

4.4 Types of lamps
4.5 Comparison of fluorescent tubes and filament lamps
4.6 Requirement of good lighting
4.7 Lighting schemes for flood light

5. Electric Traction :

5.1 Advantages and disadvantages of electric traction
5.2 Comparison between A.C. and D.C. track electrification
5.3 Block diagram of A.C. locomotives
5.4 Traction effort
5.5 Crest speed, average speed and schedule speed
5.6 Factor affecting schedule speed
5.7 Simplified speed time trapezoidal curve
5.8 Mechanics of train movement

REFERENCE BOOKS :

1. Electric Drives G.K. Dubbey
2. Art & Science of Utilisation of H. PartabElectrical Energy
3. Electrical Power J.B.Gupta
4. Utilization of Electrical Power G.C. Garg & Electric Traction

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Code	Name of Paper	Lecture
EE55	**ELECTRICAL MAINTENANCE AND REPAIR**	2

RATIONALE

Many of electrical technicians employed in state electricity boards or other industries are engaged in installation, maintenance and repair of a variety of electrical machines. Such areas may include generation, transmission and distribution systems and different types of electric drive used with a variety of mechanical gadgets. Normally manufacturers of heavy electrical machines provide service manuals, instructions for installation, maintenance and fault location. This syllabus has been designed to provide certain guidelines and broad principles regarding the above activities and after undergoing this course the technician shall be fit to undertake repairs and maintenance of electrical

equipments.

CONTENTS

5.3 Over hauling of D.C. Machine
5.4 Repairing of field winding
5.5 Sparking at brushes and its remedies
5.6 Commutators and brush mechanism and its defect.

6. Maintenance and Repair of A.C Motors :

6.1 Different tests on 1- f capacitor type A.C. motor

6.1.1 Open capacitor
6.1.2 Short capacitor
6.1.3 Change of value
6.1.4 Test for open and short circuits faults
6.1.5 Checking of centrifugal switch

6.2 Over hauling, dismantling and assembling of ceiling fan and table fan
6.3 Identification of terminals of 3-phase squirrel cage induction motor
6.4 Electrical fault location
6.5 Mechanical fault location
6.6 Drying and testing of insulation
6.7 Abnormal heating at bearing
6.8 Greasing, degreasing and impregnating
6.9 Alignment and rotor balancing

7. Safety Measures :

9.1 Study of various safety devices and appliances in an electrical workshop
9.2 Safety measures for working on low, medium and high voltage main and the study the apparatus used
9.3 Use of fire fighting, electric shock treatment, first aid, and safety posters etc.

Code	Name of Paper	Lecture
EE561	**ELECTROMAGNETIC FIELD THEORY**	2

CONTENTS

1. Introduction :

1.1 Various co-ordinate system
1.2 Coulomb's law and electric field intensity
1.3 Gauss's law
1.4 Divergence and divergence theorem
1.5 Potential and potential difference

1.6 Potential field of a system of charge
1.7 Potential gradient
1.8 Energy density in electrostatic field

2. Conductors in Electric Field :

2.1 Point form of Ohm's law
2.2 Boundary condition for conductors
2.3 Capacitance
2.4 Dielectric material and polarisation
2.5 Spontaneous polarisation
2.6 Piezo electric materials
2.7 Boundary condition between perfect dielectric
2.8 Poisson's and Laplace's equation
2.9 Uniqueness theorem and its significance
2.10 Solution of Poisson's and Laplace's equation

3. Steady Magnetic Fields :

3.1 Bio-Savart law
3.2 Ampere's circuital law
3.3 Curl
3.4 Stoke's theorem
3.5 Magnetic flux density
3.6 Vector magnetic potential
3.7 Potential energy of magnetic field

4. Time Varying Fields :

4.1 Maxwell's equation (point and integral form) and its application
4.2 Laws of circuit theory
4.3 Skin effect
4.4 Wave equations

REFERENCE BOOKS :

1. Electro Magnetic Field Theory Hayt
2. Electro Magnetic Kraus
3. Electro Magnetic Gupta & Seth

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Code	Name of Paper	Lecture
EE56	**ELECTRICAL TRACTION SYSTEM**	2

2		

CONTENTS

REFERENCE BOOKS :

1. A Course in Electrical Power J .B. Gupta
2. Utilisation of Electric Power & Electric traction G.C. Gay
3. Art & Science of utilisation of Electrical Energy H. Partab
4. Electrical Utilization & Traction Yash & Basant

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Code	Name of Paper	Lecture
EE61	**ELECTRICAL MACHINES - III**	3

CONTENTS

1. Special Machines :

1.1 Basic principles, operation and characteristics of -

1.1.1 Linear induction motor
1.1.2 Reluctance motor
1.1.3 Hysteresis motor
1.1.4 Stepper motor
1.1.5 Induction regulator
1.1.6 Brush less D.C. motor

1.2 Industrial applications

2. Cross Field Machines :

2.1 Construction and working of -

2.1.1 Metadyne
2.1.2 Amplidyne

2.2 Operating characteristics
2.3 Applications of amplidyne and metadyne

3. A.C. Commutator Motors :

3.1 Action of commutator in an A.C. machines
3.2 Functions of brushes
3.3 Concept of phase advancing
3.4 The e.m.f. of a single phase commutator motor

3.4.1 e.m.f. produced by rotating field
3.4.2 e.m.f. produced by pulsating field

3.5 Commutation in A.C. machines

3.6 The single phase A.C. series motor

- 3.6.1 Constructional features
- 3.6.2 Torque equation
- 3.6.3 Phasor diagram
- 3.6.4 Characteristics and Applications

3.7 Repulsion motor

- 3.7.1 Mechanics of torque production
- 3.7.2 Compensated repulsion motor
- 3.7.3 Vector diagram

3.8 Repulsion induction motor
3.9 Schrage motor

- 3.9.1 Construction
- 3.9.2 Characteristics
- 3.9.3 Application

4. D.C. Machines :

4.1 Load sharing in parallel operation of D.C. shunts generators
4.2 Load sharing in parallel operation of D.C. Compound generators
4.3 Load sharing in parallel operation of D.C. series generators

5. Synchronous Machines :

5.1 Transient behaviour
5.2 Reactance
5.3 Symmetrical short circuit
5.4 Power angle (cylindrical rotor) characteristics
5.5 Swing equation and curve, M and H constants
5.6 Steady state stability
5.7 Transient stability
5.8 Equal area criterion of stability

- 5.8.1 One of the parallel lines suddenly switched off
- 5.8.2 System fault and subsequent circuit isolation

5.9 Hunting phenomenon in synchronous machines

REFERENCE BOOKS :

1. Generalised Theory of Electrical Machines P.S.Bhimbra
2. A.C. Commutator Machines A.E.Clayton

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Code	Name of Paper	Lecture
EE62	**MICROPROCESSOR AND ITS APPLICATION**	3

CONTENTS

4. Programming and Application of Microprocessor :

4.1 Some examples of assembly language programme
4.2 Introduction to circuits (block diagram only) used in electrical application

4.2.1 ADC
4.2.2 DAC
4.2.3 Analog Multiplexer
4.2.4 Sample and Hold
4.2.5 Programmable peripheral interface (PPI)

4.3 Microprocessor based Protective Relay

4.3.1 Over current relay
4.3.2 Impedance relay
4.3.3 Reactance relay
4.3.4 MHO relay
4.3.5 Directional relay

4.4 Measurement of Electrical Quantities :

4.4.1 Frequency measurement
4.4.2 Phase angle and power factor measurement
4.4.3 Voltage and current measurement
4.4.4 Power and energy measurement

4.5 Measurement of Physical Quantities :

4.5.1 Temperature measurement
4.5.2 Deflection measurement
4.5.3 Water level indicator
4.5.4 Angular speed

4.6 Traffic Control.

	Name of Paper	**Lecture**
EE63	**SWITCHGEAR AND PROTECTION**	3

CONTENTS

1. Faults in Power System :

1.1 Sources of faults
1.2 Percentage reactance and base KVA
1.3 3-phase short circuits on alternator

1.4 Calculations of short-circuit KVA current
1.5 Construction of reactors
1.6 Limitations of fault current
1.7 Location of reactor

2. Symmetrical Components :

2.1 Operator 'a'
2.2 Determination of sequence components
2.3 Sequence impedance and sequence network
2.4 Types of faults at the terminals of unloaded alternator
2.5 Determination of fault current

3. Fuses :

3.1 Definition of various related terms
3.2 Selection of fuse materials
3.3 Types of fuses
3.4 Application of H.R.C. fuses
3.5 Drop out fuse
3.6 Advantage and disadvantage of fuses

4. Circuit Breakers :

4.1 Basic construction of circuit breaker
4.2 Arc phenomenon
4.3 Arc extinction methods
4.4 Interruption of capacitive current
4.5 Current chopping
4.6 Resistance switches
4.7 Construction, working and application of

4.7.1 Oil circuit breaker

4.7.1.1 Bulk oil C.B.
4.7.1.2 Minimum oil C.B.

4.7.2 Air Circuit breaker
4.7.3 Air blast circuit breaker
4.7.4 Vacuum circuit breaker
4.7.5 SF6 circuit breaker

4.8 Ratings of circuit breakers

5. Protection :

5.1 Principle of protection systems
5.2 Basic requirement of relays
5.3 Classification of relays according to construction, uses and operating time
5.4 Types o f relays (construction, setting and applications)

5.4.1 Thermal relay
5.4.2 Electromagnetic relay
5.4.3 Induction type relay
5.4.4 Differential type relay
5.4.5 Distance relay

5.5 Over current, reverse power and earth leakage protection
5.6 Static relays

5.6.1 Basic elements
5.6.2 Applications

6. Protection of Alternator :

6.1 Field failure
6.2 Field earth fault
6.3 Over current
6.4 Phase unbalance and insulation protection
6.5 Differential and restricted earth fault schemes
6.6 Protection against prime mover failure

7. Transformer Protection :

7.1 Over current
7.2 Earth fault
7.3 Differential protection
7.4 Buchholz relay
7.5 Differential scheme for the protection of generator - transformer units.

8. Line Protection :

8.1 Differential pilot wire systems
8.2 Time graded directional over current and earth fault protection
8.3 Elements of distance protection and power line carrier protection

9. Over Voltage Protection :

9.1 Causes of over voltage
9.2 Lightning surges
9.3 Protection of line against over voltage
9.4 Function of ground wire
9.5 Horn gap
9.6 Lightening arrestors
9.7 Insulation coordination

REFERENCE BOOKS :

1. Switchgear & Protection Sunil S.Rao
2. A Course in Electrical Power Soni, Gupta & Bhatnagar
3. Switchgear & Protection M.Chander & Ravindranath
4. Electrical Power System C.L. Wadhwa.

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Code	Name of Paper	Lecture
EE64	**ELECTRICAL INSTALLATION AND DESIGN**	2

CONTENTS

1. Design of Distribution Mains :

1.1 Design and estimate the material required for the following with specifications -

1.1.1 L.T. Overhead distribution main.
1.1.2 11 KV H.T. Overhead distribution main.
1.1.3 11 KV H.T. underground distribution main.

2. Sub Station :

2.1 Classification of substations

2.1.1 Indoor and Outdoor substation
2.1.2 Pole mounted substation
2.1.3 Platform type substation
2.1.4 Industrial substation

2.2 Selection of site for distribution substation
2.3 Estimation of required materials of distribution substation

3. Description and Layout of Grid Substation 33/11 and 220/132 KV :

3.1 Selection of site
3.2 Equipment used in G.S.S. with specification
3.3 Layout of G.S.S.
3.4 Single line diagram
3.5 Connection diagram of 33/11 and 220/132 KV G.S.S.
3.6 Estimate of materials
3.7 Determination of cost as per given rate schedule
3.8 G.S.S. Earthing

4. Design of a Distribution Scheme for a Small Colony :

4.1 Load survey
4.2 Load curve
4.3 Rating of sub-station transformer
4.4 Conductor size
4.5 Arrangement of street lighting
4.6 Arrangement of conductors on poles
4.7 Plan of distribution route

Code	Name of Paper	Lecture
EE65	**CONTROL SYSTEM ENGINEERING**	3

CONTENTS

1. Control System :

1.1 Basic definition
1.2 Open loop and Closed loop systems
1.3 Transfer function
1.4 Transfer function of physical system (RC ladder network)
1.5 Block diagram and its reduction technique
1.6 Signal flow graph and Mason's gain formula

2. Control System Components :

2.1 D.C. Servo motor
2.2 A.C. Servo motor
2.3 Synchro pair
2.4 Tachogenerator

3. Time Domain Analysis :

3.1 Impulse response function
3.2 First and second order systems
3.3 Step response of second order system
3.4 Stability of control system
3.5 Routh's stability criterion
3.6 Static and dynamic error coefficients

4. Frequency Response :

4.1 Frequency domains analysis
4.2 Frequency response representation

4.3 Bode plot
4.4 Polar plots
4.5 Nyquist stability criterion

5. Root Locus :

5.1 Introduction
5.2 Rules for constructing root loci
5.3 Root locus plots
5.4 Effect of Zeros and Poles on root locus

REFERENCE BOOKS :

1. Control System Engg. Nagrath & Kothari
2. Control System B.C. Kuo
3. Control System Engg. Ogata

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Code	Name of Paper	Lecture
EE662	**ELECTRICAL MACHINES DESIGN**	2

CONTENTS

1. Basic Design Principles :

1.1 Basic considerations
1.2 Limitations in design
1.3 Electrical conductive materials (Aluminum, copper and super conductor)
1.4 Magnetic materials (Diamagnetic, Paramagnet, ferromagnetic and CROS)
1.5 Insulating materials (Fibrous materials, Liquid insulating materials, ceramic, adhesive and enameled)

2. Heating, Cooling and Ventilation of Electrical Machines :

2.1 Mode of heat transfer

2.1.1 Conduction
2.1.2 Convection
2.1.3 Radiation

2.2 Equation of Heating and Cooling of Machine
2.3 Heating and cooling time constant
2.4 Types of enclosures

2.5 Methods of ventilation and cooling

2.7 Cooling air circuit

- 2.7.1 Radial
- 2.7.2 Axial
- 2.7.3 Combined
- 2.7.4 Multiple inlet

2.8 Closed circuit hydrogen cooling
2.9 Quantity of coolants required
2.10 Electric machine duty cycles
2.11 Calculation of motor rating

- 2.11.1 Average loss method
- 2.11.2 Equivalent current method
- 2.11.3 Equivalent power method

2.12 Characteristics of different cooling media like oil, air, hydrogen and water

3. D.C. Machine Design :

3.1 Choice of specific magnetic and specific electric loading
3.2 Output equation (Armature Design)
3.3 Calculation of main dimensions
3.4 Output coefficients
3.5 Choice of number of poles
3.6 Design of shunt field winding

4. 3-Phase Induction Motor Design :

4.1 Choice of specific magnetic and specific electric loading
4.2 Output equations
4.3 Calculation of main dimensions
4.4 Relation between D and L
4.5 Effect of length of air gap on motor performance
4.6 Calculation of no load current

5. 3-Phase Alternator Design :

5.1 Choice of specific magnetic and specific electric loading
5.2 Output equation
5.3 Calculation of main dimensions
5.4 Cooling of alternator

6. Transformer Design :

6.1 Choice of specific magnetic and specific electric loading
6.2 Output equation for 3-phase transformer
6.3 Main dimensions of 3-phase transformer

6.4 Winding design
6.5 Magnetising current calculation
6.6 Design of tank and cooling tubes

7. Design of Motor Starters :

7.1 D.C. shunt motor starter
7.2 D.C. series motor starter

REFERENCE BOOKS :

1. Electrical Machine Design R.K. Agarwal
2. Design of Electrical Machines V.N. Mittle & A. Mittal
3. A Course in Electrical Machine Design A.K. Sawhney

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Code	Name of Paper	Lecture
EE663	**POWER SYSTEM ANALYSIS**	2

CONTENTS

1. Economic Aspects of Generation :

1.1 Factor affecting the cost of generation
1.2 Cost reduction by power station inter connection
1.3 Load curves, load duration curves, calculation of cost per unit
1.4 Need of improvement of power factor
1.5 Incremental rate of generation and condition for economic loading

2. Combined Operation of Power Stations :

2.1 Advantage of interconnection
2.2 Base load, peak load and load allocation among different power station
2.3 Effect of change in excitation and change in fuel supply on load sharing of alternator
2.4 Load frequency control

3. Voltage Regulation in Power System :

3.1 Control of generator voltage
3.2 Tap changing transformer
3.3 Shunt capacitors and synchronous phase modifier

3.4 Series capacitors, shunt reactors and static VAR compensators

4. Power System Stability :

4.1 Power angle diagram and maximum steady state power
4.2 Steady state stability and its improvement
4.3 Transient stability, swing equation and introduction to equal area criterion

5. EHV Transmission :

5.1 Requirement and design consideration of EHV lines
5.2 Selection and spacing of conductor
5.3 Corona and radio interference
5.4 Insulation requirement

6. HVDC Transmission :

6.1 Limitation of high voltage ac transmission
6.2 Advantages and limitation of HVDC transmission
6.3 Principal parts of generating station
6.4 Application of HVDC system
6.5 HVDC system in India

REFERENCE BOOKS :

1. Generation of Electrical Power B.R. Gupta
2. Power System Design M.V. Despandey
3. Electrical Power System Nagrath & Kothari
4. Elements of Power system Stevension

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Code	Name of Paper	Lecture
CE671	**MANAGEMENT**	2

Common for All Branches of Engineering

CONTENTS

1. Principles of Management :

1.1 Management, administration and organisation, difference between them.
1.2 Scientific management : Meaning, characteristics, object and advantage :

Taylor's scientific management - Fayol's principles of management, functions of management
1.3 Types of ownership, sole trading, partnership, joint stock, co-operative and public enterprise
1.4 Types of organisation, different types and their charts.
1.5 Importance of human relation professional ethics
1.6 Need for leadership, leadership qualities
1.7 Motivation

2. Human Resources Development :

2.1 Introduction, object and functions of human resource development department
2.2 Recruitment, sources and methods of selection, need for effective training, method of training, duties of supervisor / Formen, role of HRD in industries.

3. Wages and Incentives :

3.1 Definition and requirements of a good wage system methods of wage payment
3.2 Wage incentives - type of incentive, difference in wage incentive and bonus, incentive to supervisor.

4. Material Management :

4.1 Purchasing Functions and duties of purchase department organisation of purchase department, methods of purchasing, purchase order contracts, legality of contracts types of contracts i.e. piece work contract, lumpsum contract, item rate contract, percentage contract, merits and limitation of each contract system, departmental execution of works, rate contract - D.G.S & D and C.S.P.O. tender, necessity, types of tenders, tendering procedure, earnest money and security money
4.2 Store and store keeping : Functions and duties of store department, location and layout of store, bin cards, store ledger, receipt and issue procedure of materials, physical verification of stores, disposal method of unserviceable articles and protection of stores.
4.3 Sales : function and duties of sales department sales promotion advertisement service after sales.

5. Financial Management :

5.1 Function and duties of finance department
5.2 Brief idea of journal, ledger, trial balance, trading account, profit and loss account, balance sheet.
5.3 Cheques (crossed and bearer), draft, promissory note, letter of credit, brief idea of cost accounting.
5.4 Numerical problems.

6. Marketing Management :

6.1 Concept of Marketing

6.2 Problems of Marketing
6.3 Pricing policy
6.4 Distribution channels and methods of marketing

7. Tax System and Insurance :

7.1 Idea of income tax, sales tax, excise duty and custom duty
7.2 Industrial and fire insurance, procedure for industrial insurance.

8. Labour Legislation and Pollution Control Acts :

8.1 Industrial acts : factory act 1948
8.2 Workmen's compensation act 1923
8.3 Apprentices act 1961
8.4 Water pollution contract act 1974 and 1981
8.5 Air pollution contract act 1981
8.6 Environmental protection act 1986
8.7 Forest (animal conservation act 1972)
8.8 Pollution control provisions in motor vehicle act.

9. Entrepreneurship Development :

9.1 Role of entrepreneurship and its advantages
9.2 Distinction between an entrepreneur and a manager
9.3 Project identification and selection
9.4 Project formulation
9.5 Project appraisal

REFERENCE BOOKS :

1. Industrial Management V.K. Sharma & O.P. Harkut
2. Industrial Engg. & Management O.P. Khanana
3. Industrial Engg. & Management T.R. Banga

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Code	Name of Paper	Lecture
EF55	**LINEAR INTEGRATED ELECTRONIC CIRCUITS**	3

EL 55

CONTENTS

1. IC Fabrication :

1.1 Basic monolithic integrated circuit
1.2 General IC processing steps

1.2.1 Epitaxial growth
1.2.2 Masking and etching
1.2.3 diffusion of impurity
1.2.4 Metallization

1.3 Transistor for monolithic circuit
1.4 Monolithic diode
1.5 Integrated resistor
1.6 Integrated capacitor
1.7 Concept of SSI, MSI, LSI and VLSI

2. Operational Amplifier :

2.1 OP AMP, symbol, equivalent circuit and characteristics.
2.2 Differential amplifier and its configurations
2.3 Working of emitter coupled differential amplifier
2.4 Characteristics of ideal and practical OP-AMP
2.5 Block diagram of OP AMP
2.6 Inverting and non-inverting OP AMP
2.7 OP AMP parameters and their measurements
2.8 Off set null techniques
2.9 OP AMP applications as :

2.9.1 Adder, subtractor, differential amplifier and instrumentation amplifier
2.9.2 Differentiator and integrator
2.9.3 Peak detector, precision rectifier
2.9.4 Log and anti log amplifier
2.9.5 Wein bridge and RC phase-shift oscillator
2.9.6 Pulse, square, triangular and sawtooth wave generator
2.9.7 Comparator and Schmitt trigger
2.9.8 Active filters (single order) - LPF and HPF
2.9.9 Sample and hold circuit
2.9.10 Frequency selective amplifiers

3. Timer Chip 555 :

3.1 Functional block diagram and working
3.2 555 Applications as :

3.2.1 Saw tooth generator
3.2.2 BMV, AMV and MMV
3.2.3 PWM and PPM

4. Voltage Regulation :

4.1 Need of voltage stabilisation
4.2 Transistor series voltage regulator - open loop and close loop
4.3 Short circuit and overload protection circuit
4.4 Functional diagram of IC voltage regulator chip (fixed and variable) 723 and 78XX, 79XX
4.5 Voltage regulator using OP-AMP

Code	Name of Paper	Lecture
CH572	**COMPUTER IN BUSINESS SYSTEMS**	2

Common for All Branches of Engineering except CS & IT

CONTENTS

1 Business Data Processing :

1.1 Business System
1.2 Management Functions
1.3 Levels of Management
1.4 Information Requirement
1.5 Basic tasks in business data processing
1.6 Examples of business data processing Payroll, Financial, Accounting, Inventory

2 Business Files :

2.1 Files, Records, Fields, Elements
2.2 Fixed and Variable Length Records
2.3 Master File, Transaction File
2.4 Record Updating in Sequential File and Direct File

3 Design, Analysis and Development of :

3.1 Computerized Invoicing

3.1.1 Data Entry Screens
3.1.2 Validations
3.1.3 Receipt Data Entry
3.1.4 Reports

3.2 Computerized Payroll

3.2.1 Factors Involved in Payroll
3.2.2 Exposure to structure, processing and reports
3.2.3 File maintenance

3.3 Computerized Inventory Control

3.3.1 Introduction and Aim of Inventory
3.3.2 Inventory Costs
3.3.3 Inventory Control Process
3.3.4 Inventory transactions
3.3.5 Inventory reports

4 FoxPro (A tool for Business System) :

4.1 Starting FoxPro
4.2 FoxPro Menus and Menu Options, Elementary Level
4.3 Creating Data Base File (DBF)
4.4 Adding and Editing Records : Browse, Append
4.5 Viewing Records
4.6 SET commands : Talk, Date, Century, Default, Printer, Deleted, Safety
4.7 Querying DBF : Simple and RQBE
4.8 Updating, Deleting and recalling records
4.9 Sorting, Indexing and Searching
4.10 Screen, Label, Menu, Report Generator